THE

AMERICAN JOURNAL

OF THE MEDICAL SCIENCES.

MARCH, 1910.

ORIGINAL ARTICLES.

CONGENITAL SINGLE KIDNEY, WITH THE REPORT OF A CASE; THE PRACTICAL SIGNIFICANCE OF THE CONDITION, WITH STATISTICS.*

BY JAMES M. ANDERS, M.D., LL.D.,

PROFESSOR OF MEDICINE AND CLINICAL MEDICINE IN THE MEDICO-CHIRURGICAL COLLEGE, PHILADELPHIA.

THE subject of "single kidney" is admittedly of considerable surgical and anatomical importance, but it is also one of decided interest to the internist and pathologist. The condition was known to and imperfectly described by some of the early writers, more particularly Vesalius and Eustachius. Various classifications of "unsymmetrical kidney" have been proposed—first by Morgagni in 1769, and later by Rokitansky, Morris, and other writers. These have, as a rule, included cases in which one kidney is merely atrophied as the result of disease, or undeveloped, and also the instances due to a fusion of the two organs. I have, however, discussed here only cases in which one kidney is entirely and congenitally absent. All those instances in which any rudiments or remnants of renal structure were detectable in the situation of the kidney have been omitted from consideration.

As regards the frequency of occurrence of the condition, there is marked diversity of opinion among writers. According to MacDonald Brown,[1] cases of single kidney are exceedingly rare. For example, in nearly 12,000 autopsies made in the various London hospitals prior to 1893, only 3 cases were found. He continues:

---

* Read at a meeting of the College of Physicians of Philadelphia, December 1, 1909; and in a modified form at a meeting of the Luzerne County Medical Society, Wilkes-Barre, Pa., November 24, 1909.

"Indeed, only slightly over 100 cases have been recorded altogether, and even many of these were doubtfully true 'single kidney.'" Morris[2] observed but 2 cases in 8069 cadavers, Sangalli[3] 3 cases in 5348 necropsies, Menzies[4] 2 cases in 1790 sections, Petersen 1 case in 1500, Camargo[5] 2 cases in 3000, Owtschinniskow[6] 1 in 3800, White and Martin (quoting Mawkiewicz[7]) 1 in 3992, and Rootes[8] 1 instance in 600 autopsies. Ballowitz[9] prosected 617 bodies (of which 121 were females), and found 1 example of "single kidney" associated with defective development of the genitalia of the same side. He also observed 2 additional cases through the courtesy of his colleagues. Preindelsberger[10] found 2 instances of "single kidney" in 1344 sections, Reinfelder,[11] in the Munich Pathological Institute, met with 1 case in 400 autopsies, and Winter's[12] statistics show 13 cases out of 32,415 sections. Heiner[13] (through the courtesy of Dr. Sternberg) presents the figures of the Prosector at Brunn. Out of 8853 sections, from 1895 to 1905, 3 cases of asymmetrical kidney were found. Again, of 2145 sections, from 1906 to February, 1908, two subjects showed total absence of one kidney.

Among American authors, I find Weir[14] contending that single kidney occurs only once in 5000 subjects, and Guiteras[15] found, on analyzing a table of 15,904 autopsies, that in four cadavers there was absence of one kidney, that is, complete absence of one organ in about 4000 instances. Says Dennis,[16] according to available statistics, complete absence or extreme atrophy of one kidney is found once in 2650 cases. The statistics obtained from the records of routine postmortem work in certain leading hospitals of Philadelphia give somewhat similar results. For example, at the Pennsylvania Hospital 1 case was met with in 1250 postmortems; in 600 necropsies conducted at the Protestant Episcopal Hospital by Dr. William Egbert Robertson no case of the sort was encountered. Dr. C. Y. White informs me that he has not met with a single case of complete absence of one kidney in a personal experience covering 1800 autopsies. On the other hand, the records of the Philadelphia Hospital furnish 8 cases out of a total of 6240 autopsies (see table).

Moore[17] (in 1898) found, in averaging certain previous statistics that the "expectation" of "unsymmetrical kidney" was about 1 in 2400 autopsies. The aggregate of the foregoing figures, together with those accessible among the hospitals of Philadelphia, at the present writing, or a grand total of 92,690 postmortems, gives a ratio of 1 in 1817 autopsies.

The precise number of cases of congenital single kidney recorded in literature, answering to the definition given above, remains somewhat in doubt on account of the vague character of the reports of some of the earlier writers. Ballowitz,[18] in 1895, collected from the literature 210 cases, which, in addition to 3 observed by himself, gave a total of 213 cases. Moore, in 1898, published 12 additional references, and thus brought the total number up to 225 cases in that year.* The two writers last cited (like myself) aimed to exclude those instances of "unsymmetrical kidney" in which the organ was much wasted as the result of disease processes, was undeveloped, and those resulting from fusion of the kidneys. Radasch,[10] in 1908, wrote: "If we accept 240 cases up to the appearance of Ballowitz's paper, then at least 15 more must be added, making a total of at least 255."

I have endeavored to collect the cases of genuine "single kidney" to be found in the literature since the publication of Moore's article in 1898 (a considerable number having escaped the scrutiny of more recent writers), together with a few scattered earlier cases, with a view to showing the grand total of all recorded instances of the condition to date. With the kind aid of my associate, Dr. H. Leon Jameson, I have found in accessible literature and the autopsy records of certain Philadelphia hospitals no less than 61 genuine cases, making the sum total to date 286 cases. These are reasonably accurate figures, and in future the number of cases belonging to this category need not remain in doubt, since the reports will doubtless be far less ambiguous than those of the earlier writers. I consider it to be a matter of considerable importance to have secured statistics, the results of an analysis of which point to definite conclusions, both as regards the question of "expectation" and that of the pathological and practical bearings of "single kidney." A consideration of the figures given in the accompanying table, in which 61 instances of the condition are detailed, will show interesting results. Before attempting an analysis of the tabulated list of cases, however, I shall give the notes of a case personally observed, together with various conclusions to which they point:

W. B., aged sixty-four years, a varnisher, a native of England, *weighing 160 pounds, and five feet eight inches in height,* was admitted to the Medico-Chirurgical Hospital April 10, 1909. The *family history was good, except that his father died,* at sixty-four *years of age, of Bright's disease, and one brother at the age of* sixteen, suddenly, but of unknown cause.

The patient had had all of the commoner childhood's diseases, including scarlatina; subsequently he continued well until eight or nine years ago, when rheumatism developed; it was of a subacute *type and did not confine the patient to bed;* he has had several recurrences of a similar nature during the past eight years. Last July one year ago, while working at his trade, his right arm, from elbow to finger tips, particularly on the ulnar side, as well as his right leg, *from the knee down to the toes, manifested a sense of numbness,* which, however, passed away in the course of fifteen minutes. Last July he had a similar attack, which left his hand in a drawn or partially closed condition; it is now straightened out, except that his middle finger is still distinctly contracted.

---

* This writer actually published 13 references, but one was a report of a horseshoe kidney, hence omitted.

Reporter.	Age and sex	Which absent	Ureter	Renal artery and vein	Corresponding suprarenal	Condition of genitalia	Condition of existing kidney as to size, shape, position, and lesions present.
Darby[20]	60 yrs.; female	Left	......	Absent	Absent	.....	Kidney healthy; carcinoma of bladder and lungs.
Isaacs[21]	3 mos.; male	Left	Absent	....	Present	.....	About twice natural size, 2¾ x 1¾ x 1¼ in.; lobulation characteristic of infantile kidney; healthy; deceased of pneumonia.
Turner[22]	Past middle life; female	Left	......	Absent	Present	Uterus unicornus	Not hypertrophied; no lesion.
Wier[23]	Male	Left	Absent	....	.....	.....	Enlarged, 5 oz., 2 drams; normal, healthy.
Ingals[24]	Middle aged; male	Right	Lower end dwindled for 4 in.	....	.....	.....	Normal size, roughened surface, pale and hard, cortical substance thick; contained two cysts.
Fenby and Walker[25]	...	Right	......	....	.....	.....	Enlarged, weighing 9½ oz.
Peabody[26]	21 yrs.; female	Left	Absent	Two right arteries, none on left	Present	Uterus bicornate; right side better developed	Normal situation, double normal size.
Peabody[27]	61 yrs.; male	Right	Absent	Two renal arteries to left kidney; none on right	Present; normal	Normal	Double usual size, capsule of Bowman thick; interstitial inflammation; small hemorrhagic infarction.
Church[28]	45 yrs.; female	Left	Absent	Absent	.....	.....	Very small, not larger than a large hen's egg and shaped much like one; shows interstitial nephritis.
Church[28]	65 yrs.; male	Left	......	....	.....	.....	Very large and healthy; deceased of gastric carcinoma.
Ebstein[29]	21 yrs.; female	Right	Absent	....	.....	Right cornu of uterus absent	Chronic pyelitis and chronic interstitial nephritis.
Smith[30]	33 yrs.; male	Left	......	....	.....	.....	Enlarged, weighing a little more than 7½ oz.
Hand[31]	...	Right	Absent	....	Present	.....	Compensatory hypertrophy; patient had lumbo-sacral meningocele.
Murray[32]	8 yrs.; male	Right	Absent	Two small vessels from bifurcation of aorta	.....	.....	Large kidney, dilated pelvis; impaction of ureter with calculus; situated in hollow of sacrum behind bladder, more to left than right.
Lohsse[33]	Adult; male	Left	Absent	....	.....	.....	Considerably hypertrophied, otherwise shows no pathological change.
Israel[34]	52 yrs.; male	Right	Absent	Artery absent	.....	Testicle 2 cm. long; is in pelvis	Enlarged, 12 cm. x 8 cm. x 6½ cm.; in normal position.
Bauer[35]	22 yrs.; male	Left	Absent	Present, but very small; vein absent	Present and normal	Left vas deferens and seminal vesicle absent	Slightly enlarged, weight 190 gms.; normal position and form.
Francois-Dainville[36]	...	Right	......	....	.....	.....	Very large, weighing 430 gms.; surface lobulated, somewhat congested.
Beaufume and Carron[37]	47 yrs.; male	Right	Absent	....	Right absent; left weighed 9 gms.	Right testicle small but appears sound; left in inguinal canal and is markedly atrophied	Weighs 250 gms., structure unaltered; normal situation; associated with total inversion of the viscera.

Reporter	Age and sex	Which absent	Ureter	Renal artery and vein	Corresponding suprarenal	Condition of genitalia	Condition of existing kidney as to size, shape, position, and lesions present.
Guiteras[38] (Case I)	21 yrs.; male	Right	Absent	....	.....	.....	5 x 3 x 2½ in.; lobulated, had but one pelvis; showed evidence of tuberculosis and nephritis.
Guiteras[38] (Case II)	30 yrs.; male	Right	Absent	....	.....	.....	7½ x 4 x 2½ in.; not distinctly lobulated, but somewhat irregular on surface; normal position; acute parenchymatous nephritis.
Guiteras[38] (Case III)	25 yrs.; male	Left	Absent	....	Absent	.....	4 x 2½ x 2 in.; five or 6 irregular elevations on its surface; somewhat lobulated; single pelvis; chronic interstitial nephritis.
Wilson[39]	55 yrs.; female	...	Two ureters from kidney	....	.....	Some malformation of uterus	Great size; no lesions.
Crawford[40]	62 yrs.; female	Right	Absent	....	.....	.....	"Large white" kidney; cicatrix in lower pole, result of previous tumor growth (died in coma).
Nelson[41]	20 yrs.; female	Right	Present; 3¼ inches long; closed at upper end	....	Both present and enlarged, especially right	Normal	Relation of vessels normal.
Brinkman[42]	Adult; male	Left	Absent	....	Absent	Left testicle and epididymis small	Decidedly enlarged; 16.5 x 7.5 x 5.5 cm.
Winter[43]	21 yrs.; male	Left	8 cm. long; occluded above	....	Present	Normal	One large and numerous little cysts; little normal kidney structure remaining; death due to nephrectomy.
Edington[44]	2 days; male	Right	......	Absent	Present and normal	Right vas and epididymis small	Good size, 5 x 3 x 2 cm.; normal shape, though marked lobulation; normal position shows cloudy swelling; atresia anus and hare lip.
Moore[45]	35 yrs.; male	Right	Absent	Absent	Absent; left present and normal	Normal	Considerably enlarged, 285 grams; normal position.
Moore[45]	50 yrs.; male	Left	Absent; right normal	Absent; right normal	Absent; right normal	Absence of genital apparatus on left side	Much enlarged, 480 grams; marked lobulation, otherwise normal in shape; normal position; patient had diabetes and gangrene; died of pneumonia.
Mori[46]	88 yrs.; male	Left	Absent	Artery absent	.....	.....	Large, 16 x 6 cm.
Robinson[47]	...	Left	Absent	....	.....	.....	Compensatory hypertrophy, being one-third excessively developed; normal shape.
Horrand[48]	7½ mos. male	Right	Present; crossed median line and joined left before entering left ureter; was permeable	Absent	Present	Right testicle found in inguinal canal	Lobulated and hypertrophied.
Viannay and Cotte[49]	60 yrs.; male	Right	Absent	Absent	Both present	Absence of right vas deferens and vesicula seminales and corresponding ejaculatory duct; right testicle small; right lobe of prostate somewhat smaller	Compensatory hypertrophy, 250 gms.; normal situation.

Reporter	Age and sex	Which absent	Ureter	Renal artery and vein	Corresponding suprarenal	Condition of genitalia	Condition of existing kidney as to size, shape, position, and lesions present.
Delcarde[50]	Young infant	...	......	....	.....	.....	....
Hollopeau[51]	50 yrs.; male	Right	Lower portion present, 13 cm. long; permeable and ends in blind pouch above	....	Present and apparently normal	.....	Normal situation; a little larger than normal.
Manson[52]	59 yrs.; male	Right	Absent	....	.....	.....	Large, weight 9 oz.; no pathological change.
Codina[53]	80 yrs.	...	......	....	.....	.....	Abnormal form and situation; kidney showed changes of chronic nephritis.
Scheuer[54] (Case I)	3½ yrs.; female	Left	Absent	Absent	Present	Normal	Kidney showed amyloid change.
Scheuer[54] (Case II)	60 yrs.; male	Right	Present; and permeable for 1¼ cm., otherwise absent	Artery absent	Present; normal size and situation	Normal	Very much enlarged; on section, cortex found to be thickened; capsule stripped easily.
Scheuer[54] (Case III)	20 yrs.; female	Right	Absent	Absent	Present	Right ovary missing; bicornate uterus, septum extending into bladder	Enlarged, 15 cm. long; capsule adherent; numerous abscesses of kidney, ureter, and bladder.
Scheuer[54] (Case IV)	10 days	Right	Absent	....	Present	Atresia of urethra and anus	Much enlarged, partly due to hyperplasia and partly to hypertrophy.
Brock[55]	Adult; male	Right	Absent	Artery present; vein absent	Present	Absence of testicle, vas deferens and seminal vesicle; right lobe of prostate atrophied	Increased in size, 15 x 8 x 4 cm.; normal position.
Diamantis[56]	60 yrs.; male	Left	Absent	Artery absent	Present and normal	.....	160 gms.; surface smooth and regular.
Jacquin and Marquez[57]	57 yrs.; female	Right	Absent	....	Absent; left hypercystic	Lateral version	Weight 300 gms.; lobulated; normal position; evidence of chronic nephritis.
Schmidt[58]	64 yrs., male	Right	Absent	Absent	Present	Right testicle and epididymis smaller; right seminal vesicle enlarged and is seat of round and spindle-cell infiltration; no spermatozoa present	Shows enlargement, 15 x 6¼ cm.; normal situation; no histological change.
Heiner[59]	40 yrs.; male	Left	Absent	Absent	Present	Tail of epididymis, vas deferens, seminal vesicles and ejaculatory ducts missing on right side; otherwise normal	Slight increase in size due to compensatory hypertrophy; 270 gms.; normal form and situation.
McCrae[60]	40 yrs.; female	Left	Absent	....	.....	Left ovary, tube, broad ligament and left half of uterus absent	Larger; normal position.

Reporter	Age and sex	Which absent	Ureter	Renal artery and vein	Corresponding suprarenal	Condition of genitalia	Condition of existing kidney as to size, shape, position, and lesions present.
Rendue[61]	17 mos.; male	Left	Absent	....	Present; in normal position and form	Normal	Enormous compensatory hypertrophy; 6½ x 5 x 4 cm.; weight 85 gms. (normal 40-45 gms.); globular shape; no macroscopic lesions.
Orbison[62]	31 yrs.; male	Left	Could be traced upward from bladder for a few inches; enlarged	....	Present; measured 2½ x 1¼ in. and was flattened; right like left	.....	No note of vessels; kidney 7¾ x 2⅛ in.; chronic interstitial nephritis.
Mackie[63] (Case I)	9 mos.; male	Left	......	....	.....	.....	Weighed 208 gms. and showed fatty change.
Mackie[63] (Case II)	7 mos.; male	Left	Absent	Absent	Absent	.....	Twice normal size, normal shape.
Mackie[63] (Case III)	44 yrs.; male	Left	Absent	....	.....	.....	Large, soft; shows tubercular disease.
Mackie[63] (Case IV)	34 yrs.; female	Right	Absent	Absent	Absent	Both ovaries are fibroid; small fibroid nodules in broad ligament	185 gms.; shows fœtal lobulation, is ellipsoidal; shows some fibroid and fatty change.
Mackie[63] (Case V)	53 yrs.; male	Right	Exists for most part as fibrous cord; patulous for 4cm. from bladder	....	Normal	.....	Very much enlarged, marked lobulation; shows changes of chronic nephritis.
Mackie[63] (Case VI)	49 yrs.; male	Left	Absent	Absent	Normal	.....	11.5 x 5 x 3.5 cm.; distinct fœtal lobulations; evidence of chronic nephritis.
Mackie[63] (Case VII)	63 yrs.; male	Right	Absent	Both absent	Present; enlarged and softened	.....	Usually thick; 13.5 x 4.5 x 4.5 cm.; shows chronic interstitial change with anemic infarct.
Mackie[63] (Case VIII)	40 yrs.; female	Left	Absent	....	Present	.....	16 cm. in length; pushed upward and forward and is firmly adherent to under surface of liver and diaphragm; shows extensive chronic diffuse nephritis.
Hagner[64]	40 yrs., female	Right	Absent	Absent	Absent	.....	Kidney large, pyonephrosis.
Guthrie and Wilson[65]	30 yrs.; female	Left	Absent	....	.....	Left tube, broad ligament and ovary absent; cervix closed; hematometra; lower end of vagina absent; coitus through urethra	Diagram shows remaining kidney in normal position; size and condition not described.
Anders	64 yrs.; male	Left	Absent	Absent	Left absent; right hypertrophied	Normal	Hypertrophied; weight 240 gms.; surface lobulated, in normal situation; evidence of chronic interstitial nephritis.

The patient is married, has three children, and up until three years ago he was a hard drinker, using on the average about a quart of whiskey and four or five pints of beer daily; otherwise, the social history is without significance.

The present illness began in October, 1908, at which time he noticed shortness of breath and pain across his chest upon exertion; he was easily exhausted, and complained of being constantly tired.

Out of the left eye objects appeared black, and about this time he was compelled to quit work on account of weakness and a feeling of exhaustion. During the previous month, and even subsequently, he passed large quantities of urine (about one gallon per day). In March, he had suffocating attacks, especially at night, and went to the Johns Hopkins Hospital as a patient. Here he was told that he had kidney and heart disease, and remained about five weeks.

Physical examination revealed a middle-aged white male, conscious, rational, though with tendency to stupor, falling asleep during examination; the skin was livid, being especially cyanosed over the extremities; mucous membranes also cyanotic; marked œdema of the ankles and feet, with slight wrist-drop of right arm; head and eyes normal, but nose cyanosed and cutaneous veins engorged; no teeth in upper jaw and only a few in lower; gums showed marked pyorrhœa in lower jaw, but no blue line.

The chest was emphysematous in type, and the respirations were markedly labored. The heart's apex beat was displaced outward; the impulse was short and weak. The right border of cardiac dulness was about 1 c.m. beyond the right sternal edge and the left 1 c.m. to left of the midclavicular line. The upper border was on a level with the third rib. Auscultation revealed a feeble first sound, a soft systolic whiff at apex, with slight accentuation of second pulmonic sound (relative insufficiency). There was some abdominal distention, but no ascites. Liver and spleen were slightly engorged.

On admission, the amount of urine was abnormally small, but after rest in bed, the use of saline laxatives and nitroglycerin, alternated with tincture of convallaria and digitalis, the urinary secretion increased to 64 ounces, while it again decreased during the last few days of life. The pulse was rapid, and toward the close of life compressible, while the respirations ranged abnormally high, particularly during the last four days. The temperature, which had been constantly at a subnormal level until four days prior to death, also became decidedly elevated, touching 104.6° at the time of demise. The physical signs of bronchopneumonia were present during the same period. Repeated urine analyses gave the presence of a heavy ring of albumin and numerous broad granular casts on microscopic examination; specific gravity, 1015 to 1019. The blood pressure in the recumbent posture was, systolic 168, and diastolic 138 mm. Hg.; during his stay in the hospital the blood pressure, however, declined considerably.

The ophthalmoscopic examination, made by Dr. L. Webster Fox, gave this result: Media clear; optic neuritis with marked œdema of the retina, extending back to the equator. The heads of the optic nerves completely buried, and outlines of arteries and veins quite obscured. Striæ of hemorrhages extending completely around the optic nerve entrances; apex of the swellings at least nine to ten diopters in height. The ophthalmoscopic picture is that of a most pronounced case of albuminuric retinitis.

The patient was sleepless and decidedly breathless in paroxysms at night. Prior to the fatal termination, which occurred April 24, numerous subcrepitant and moist bubbling rales were audible over bases of the lungs.

The *autopsy* was made two and one-half hours after death. No rigor mortis; body still warm to the feel. *Lungs* œdematous; pleural adhesion on both sides (no free fluid); three small areas of consolidation were found—one in left apex, another in the lower lobe of left lung, and still another in the middle lobe of the right lung. These presented the characteristic appearances observed in bronchopneumonia. *Heart* showed general hypertrophy, with considerable secondary dilatation (relative incompetence); weight, 515 grams; valves showed no pathological changes, except slight thickening of the mitral segments. The *liver* was slightly enlarged and cirrhotic; *gall-bladder* normal; *spleen,* apparently normal; *stomach* and *colon,* normal in size and position.

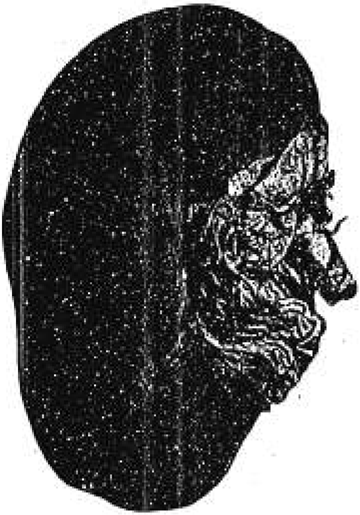

Fig. 1.—The kidney (reduced to three-fourths of its actual size). *A*, enlarged renal artery; *B*, attempt at lobulation; *C*, small retention cyst; *D*, reflected capsule.

Kidneys. The left kidney, renal artery and vein, as well as ureter, were entirely absent; also the left suprarenal body and artery could not be found. The right or existing suprarenal body was somewhat hypertrophied. It was observed that the right renal artery was somewhat enlarged, and bifurcated just before entering the existing kidney. The remaining kidney (Figs. 1 and 2) was present in the normal position and much enlarged, weighing 240 grams (8 ounces); it presented a somewhat lobulated appearance. Macroscopically, it showed evidence of interstitial nephritis. The ureter on the right side was also slightly increased in diameter, and on tracing it downward was found to enter the bladder in the normal situation. On the opposite side no indication of ureteral orifice was noted. The pelvis of the existing kidney, while proportionately increased in size, did not show the faintest evidence of an attempt at duplication. The genitalia on the side of the absent kidney showed nothing abnormal. The prostate gland was not investigated.

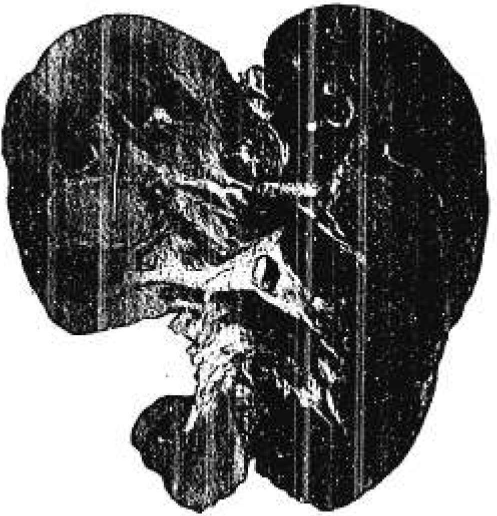

FIG. 2.—Longitudinal section of the kidney, showing a thick, somewhat irregular cortex and absence of the section removed for microscopic study (reduced to three-fourths of actual size).

Dr. E. A. Case, the pathologist, reports on the existing kidney as follows: *Macroscopically*, the capsule strips with some difficulty, leaving a granular surface, with one retention cyst, about 3 mm. in diameter. The cortex is not thinned, as in typical interstitial nephritis, but as the man only had one kidney, this fact, and also the massive size of the organ, are probably thus explained. The cortex is only a bit irregular in thickness. *Microscopically*, the glomeruli show varying changes. Some are larger than normal, with no pathological lesion save a congestion of the capillaries of the tuft. Others are shrunken; still others converted into hyaline masses surrounded by connective tissue. In some the Malpighian tuft has shrunken, leaving an appreciable space in Bowman's capsule. In some of the capsules of Bowman granular debris is to be seen, while others show marked thickening, due to the proliferation of connective tissue about them. The convoluted tubules show parenchymatous degeneration. The epithelial cells are swollen, very granular, outline between them indistinct, and the nucleus stains poorly. In the lumen of the tubules there is considerable granular material. The straight collecting tubules show less parenchymatous change, and many closely approximate the normal. The interstitial connective tissue is markedly increased, being especially marked about the glomerules, but also evident about the tubules. There is also thickening of the arterial walls. In the interstitial tissue of the cortex there is an irregular round-cell infiltration composed of mononuclear cells. The bloodvessels are congested, especially in the region of the collecting tubules and pyramids of Ferrein. It is evident that the material increase in size of the kidney is due principally to a numerical increase of certain anatomical elements. The pathological diagnosis is chronic interstitial nephritis, associated with which is a parenchymatous degeneration.

While this case was not a typical example of urogenital agenesis, it was a true instance of "single kidney," or unilateral urinary aplasia, with total absence of the suprarenal capsule on the same side—a rare and interesting anomaly. It is to be noted, therefore, that it does not lend itself to the investigation of the question of the relation of "single kidney" to anomalies of the sexual organs. On the other hand, the case funished material for a further study of the compensatory enlargement of, and of the various lesions presented by, the existing organ.

Of my own tabulated list of 61 cases, 38 were males, 16 females, and in 7 the sex was not mentioned. The right kidney was missing in 29 cases, the left in 29, and in 3 the particular side was not stated. Of the 38 males, the condition occurred on the left side in 20, and right side in 18. Of the 16 females, the left side showed renal aplasia in 8 cases and the right in 7, while in 1 the side involved was not mentioned. Ballowitz found the condition on the left side oftener than on the right in the male, the ratio being 70 to 42, while according to my figures the proportion was about even, or 20 to 18. In the female, both sides are about equally affected, according to my figures (vide supra).

The ureter of the side of the congenital aplasia was absent in 42, present to a greater or less extent in 9, and in the remaining 10 no mention was made. In 8 cases the genitalia were normal, in 19 abnormal, and in 34 instances their condition was not described. Of the 19 in which the genitalia showed hypoplasia, 11 were met with in the male and 7 in the female, while in 1 the sex was not stated. The precise character of the defects are briefly described in the tabulated list of cases, and it will be observed that they are remarkably variable, both as to degree and nature.

The suprarenal gland could not be found in 11 instances, was present in 26, and not referred to in 24. It was missing seven times in the male and four times in the female; or, in other words, in nearly even proportion in comparison to the totals for the two sexes. The renal artery was reported absent in 24 cases, present in 3, and unmentioned in 34.

The number of cases showing renal changes in the remaining organ other than mere hypertrophy was 27, those showing only hypertrophy, 7, while the renal changes were not described in 27. There were 15 cases, or 55 per cent. of the total number in which the lesions presented by the kidneys were described, that showed chronic nephritis, of which 8 were of the chronic interstitial variety. The findings in 3 cases were those of chronic parenchymatous nephritis, while 1 case presented the lesions of acute nephritis. Two patients showed tuberculous lesions, and 2 pyonephrosis; 3 had died of chronic diabetes mellitus. A single instance was furnished by each of the following conditions: Hydronephrosis, "abscessed kidney," calculus (ureteral), cystic kidney, congested kidney amyloid kidney, and fatty kidney.

A similar consideration and analysis of all of the reported cases of solitary kidney in which the points at issue are detailed, or 286, gives us somewhat different and also more important generalizations.

Sex. In 248 cases the sex was mentioned, of which 159 were males and 89 females. As stated by Ballowitz, it is to be recollected that autopsies are less commonly made in the latter than in the former sex.

Age. Of 154 cases in which the age at death was given, 34 patients were under ten years; this number, however, includes 13 premature births. Between the tenth and fiftieth years 62 cases occurred, and after the fiftieth year 58 cases. Included in my series there was 1 case which had reached eighty-eight years of age, and another eighty years. These figures would indicate that longevity is not markedly abridged by the occurrence of this condition.

Side. Out of 286 cases, the condition occurred on the left side in 153, and on the right side in 120, with 13 not differentiated. In 158 males the congenital urinary aplasia occurred ninety-six times on the left side and sixty-two on the right. Per contra, of 83 cases occurring in the female, the left kidney was missing in 40, and the right in 43. It would appear, therefore, that the proportions for the two sexes are diametrically opposed, but I am not in a position to offer a satisfactory explanation for the differences in sexual influence upon the side involved.

Out of the whole number, or 286 cases, the ureter was completely absent in 248. In 24 instances a more or less rudimentary ureter was in evidence, without the slightest indication of the presence of renal structure.

The presence or absence of the suprarenal gland was noted in 151 cases; it was present in 109 cases and absent in 42, or 27.8 per cent. In 14 cases the suprarenal gland on the side of the absent kidney was enlarged; in 2 it was atrophied. It is interesting to note that the suprarenal gland on the side of the existing kidney is rarely enlarged; for example, this was the case in 5 of the 61 cases included in my table, and in only 2 out of 111 cases tabulated by Ballowitz. In a single instance this organ was smaller than normal on the side of the remaining kidney. The condition of the genitalia was noted in 135 cases (out of the grand total, or 286), of which, 94 showed congenital defects; and 41 were obviously normal. Among the cases of genital hypoplasia were 40 males and 49 females, with 5 sexually undifferentiated.

It was found that 79 cases out of the grand total, or 170, in which the renal changes were given, or 46.5 per cent., showed morbid lesions other than mere compensatory hypertrophy. Among these 79 cases were: Chronic interstitial nephritis, 19; chronic nephritis (variety not specified), 11; chronic parenchymatous nephritis, 2; ureteral calculi, 9; pelvic calculi, 6; pyelonephritis, 10; cystic kidney, 3; tuberculosis, 2; hydronephrosis, 4; "diseased" kidney, 3; stone in the bladder, 1; carcinoma of kidney, 1; "cloudy swelling," 1; congested kidney, 1; amyloid kidney, 1; fatty kidney, 1; and abscess of kidney, 1.

Ballowitz speaks of the frequent occurrence of nephrolithiasis being emphasized by the older writers, and Mosler[66] refers to the danger to the individual attending disease processes affecting single kidney. The results of the combined statistics of Ballowitz, Moore, and my own indicate clearly that a greater than the normal percentage among subjects of congenital single kidney die of kidney complaints, as will be shown hereafter. Unquestionably nephrolithiasis is attended with peculiar danger to life in cases of single kidney in which the stone occludes the ureter. Obviously an effort should be made to remove promptly the calculus when single kidney is known to exist, after locating it by means of radiography. Indeed, the condition calls for unusual promptness if it is expected to save life. Obstruction of the ureter by a calculus has occurred after nephrectomy, and has been relieved by timely nephrotomy. Complete occlusion of a single ureter tends to the development of uremia, ending in death. The operation should be done at the end of forty-eight hours if spontaneous relief is not afforded.

Says Ransohoff,[67] there are records of eleven operations of solitary kidney—four nephrotomies and seven nephrectomies. The nephrectomies were fatal in from one to eleven days. The patient of Polk[68] lived eleven days. Traumatic rupture of a solitary organ caused death (as was to be expected) in a case reported by Taylor.[69] It is important to recollect that the ureteral orifice is generally absent on the side of the missing kidney. It follows that under these circumstances the condition under consideration is demonstrable by means of a cystoscopic examination; this should be, however, supplemented by catheterization of the ureters in cases in which two ureteral orifices exist, since in a small percentage of the cases of congenital single kidney a rudimentary ureter is present, extending upward from the bladder for a variable distance. It is highly probable that in a certain proportion of the latter instances, at least, the catheter could be introduced into the ureter for a short distance, but, obviously, not any urine could be segregated.

The importance of single kidney from a surgical standpoint can scarcely be overemphasized. The subject is also of special interest to the pathologist and internist, as shown by the fact that the advanced lesions of chronic nephritis were found in 32 of the fatal cases, or 42.3 per cent. Finally, it cannot be doubted that the development of either acute or chronic nephritis in cases in which renal agenesis exists gives a less hopeful outlook than when these arise under normal conditions, that is, bilaterally.

BIBLIOGRAPHY.

1. Variations in the Position and Development of the Kidneys, Journal of Anatomy and Physiology, 1894, vol. xxviii, N. S. vol. viii, p. 196.

2. An Address on Some Points on the Surgery of the Kidneys, British Medical Journal 1885, i, 314.

3. Reale Instituto Lombardo di scienze e lettere. Rendiconti, Ser. ii, vol. ix, Milano, 1876, p. 488.

4. Two Cases of Single Kidney, Journal of Anatomy and Physiology, 1887, xxi, 510.

5. Revue de la Suisse Romande, No. 10.

6. Ueber einen Fall von angeborenem Nierenmangel, Monatsberichte für Urologie, Band x, S. 63.

7. Ueber Nierenoperationen bei Mangel oder Erkrankung der zweiten Niere, Monatsberichte für Urologie, 1900, Band v, S. 511.

8. Lancet, 1866, ii, 251.

9. Ueber angebornen, einseitigen, vollkommenen Nierenmangel, Archiv für pathologische Anatomie und Physiologie und für klinische Medicin, 1895, Band cxli, p. 309.

10. Beitrag zur Nierenchirurgie, Wiener klinische Rundschau, 1901, Band xv.

11. Ein Fall von beiderseitiger Verdoppelung der Nieren und Ureteren usw., Inaugural Diss., München, 1905.

12. Ueber einseitige angeborene Nierendefekte usw., Archiv f. klin. Chir., 1903, Band lxix.

13. Kongenitale Nierendystopie und kongenitaler Nierendefekte mit Anomalien der ableitenden Samenwege, Folia Urologica, October, 1908, Band iii, p. 186.

14. New York Medical Journal, December 27, 1884.

15. St. Louis Medical and Surgical Journal, 1903, lxxxiv, 139.

16. New York Medical Journal, January 30, 1904.

17. Unilateral Renal Aplasia, Journal of Anatomy and Physiology, 1898–99, xxxiii, 400.

18. Loc. cit.

19. Absence of Urogenital System, AMER. JOUR. OF THE MED. SCI., July, 1908.
20. Proceedings of the Philadelphia Pathological Society, 1857 to 1860, p. 199.
21. New York Journal of Medical and Collateral Sciences, 1858, vol. v, S. 3, p. 218.
22. Edinburgh Medical Journal, 1865, x, ii, 687.
23. Indian Medical Gazette, Calcutta, 1872, vii, 272.
24. Chicago Medical Journal and Examiner, 1875, xxxii, 897.
25. Medical Record, N. Y., March 12, 1881, p. 304.
26. Ibid., June 11, 1881, p. 665.
27. Ibid., 1882, xxii, 85.
28. Journal of the American Medical Association, 1884, ii, 19.
29. Archiv für pathologische Anatomie und Physiologie und für klinische Medicin, 1896, cxlv, 158.
30. Medical Record, New York, 1896, p. 718.
31. Trans. Path. Soc. of Philadelphia, 1897, xviii, 323, 408.
32. Liverpool Medico-Chirurgical Journal, 1899, xix, 116.
33. Münchener medicinische Wochenschrift, 1901, lxviii, 1304.
34. Chirurgische klinik der Nierenkrankheiten, Berlin, 1901, p. 1.
35. Bull. et mém. de la Soc. anat. de Paris, 1901, lxxvi, 339.
36. Ibid., 1902, lxxvii, 173.
37. Ibid., 1902, lxxvii, 1006.
38. St. Louis Medical and Surgical Journal, March, 1903, p. 129.
39. Boston Medical Journal, July 11, 1903, p. 120.
40. Virginia Medical Semi-monthly, August 21, 1903.
41. Boston Medical Journal, November 21, 1903, p. 1333.
42. Medicinisch-Chirurgische Centralblatt, 1903, xxxviii, p. 562.
43. Archiv f. klin. Chir., Berlin, 1903, lxix, 629.
44. Journal of Anatomy and Physiology, London, 1903-04, xxxviii, 476.
45. Ibid., p. 71.
46. Giornale Internazionale del scienze Mediche, 1904, xxvi, 274.
47. St. Paul Medical Journal, 1904, vi, 699.
48. Lyon médicale, 1905, civ, 718.
49. Ibid., 1906, cvi, 516.
50. Nord médicale, Lille, 1906, xii, 209.
51. Bull. et mém. de la Soc. anat. de Paris, 1906, lxxxi, 408.
52. British Medical Journal, 1907, ii, 1827.
53. Rev. de Med. y Cirurg. pract., Madrid, 1907, lxxv, 349.
54. Zeitschrift für Heilkunde, 1907, xxviii, 120.
55. Anat. Anzeiger, Jena, 1907, xxxi, 417.
56. Bull. et mém. de la Soc. anat. de Paris, 1907, lxxxii, 43.
57. Jour. de médecine de Bordeaux, 1907, lxxxii, 43.
58. Zeigler's Beiträge z. path. Anat. u. z. Allg. Path., 1907, xlii, 510.
59. Folia Urologica, 1908, iii, 186.
60. Montreal Medical Journal, 1908, xxxvii, 177.
61. Lyon médicale, 1908, cx, 1040.
62. Pennsylvania Hospital Autopsy Records, 1909.
63. Collected by Dr. R. B. Mackie from the postmortem records of the Philadelphia General Hospital, with the permission of Dr. Joseph Neff, Director of Public Health and Charities.
64. Journal of the American Medical Association, October 30, 1909, liii, 1481.
65. Annals of Surgery, November, 1909, l, 5, p. 907.
66. Archiv der Heilkunde, 1863, iv, 289.
67. Keen's Surgery, iv, 200.
68. Extirpation of a Single Displaced Kidney, New York Medical Journal, 1883, xxxvii, 171.
69. British Medical Journal, 1870, ii, 485.